

# GENESIS SOLAR COMPOSITION: PAST, PRESENT, AND FUTURE.

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**Past:** The Genesis Discovery Mission returned samples of solar matter by exposing ultrapure materials to the solar wind for 27 months in 2002-04. The science objectives are: (I) measure solar isotopic abundances to planetary science precision requirements. (II) improve knowledge of solar elemental abundances. (III) independently sample the 3 solar wind regimes. Except for the earth return crash, the mission was nominal. We recovered sufficient pieces to make analyses.

**Present:** Science planning for the mission was based around 19 prioritized "measurement objectives". To date we have published results on the 4 highest priority objectives: (A) O isotopic composition (1); (B) N isotopic composition (2); (C) Noble gas elemental and isotopic abundances (3); (D) Noble gases in regime samples (4). We have also shown that a proposed high fluence of energetic solar particles ("SEP") can be understood instead in terms of isotopic fractionation during ion implantation (5).

We have shown that the Sun and inner solar materials are systematically different in the isotopic composition of O and N. The N isotopic composition of the Sun and the atmosphere of Jupiter are the same within errors. The full implications of these differences are still unknown.

The feasibility of SIMS analyses of elemental abundances has been demonstrated for many years, but obtaining high precision data has been hindered by crash-derived surface contamination and by the need to understand the errors associated with implant standards. We have learned how to calibrate the implants when necessary. For the highest precision, in the case of Fe and Mg, we have implanted flight samples to provide internal standards. Using the technique of back-side depth profiling (e.g. 6) greatly reduces surface contamination. We now have reasonably precise abundances for C,N,O,Mg,Al,Ca,Fe. The Fe/Mg ratio is lower than that for CI chondrites by about 2 sigma (7).

**Future.** In the next two years, significant new Genesis results can be anticipated. Mg isotopes will provide a good test of Sun-solar wind isotopic fractionation. C isotopes will see if the major Sun-terrestrial planet difference for O and N extend to the other major planet-forming volatile element. Spacecraft data indicate that elemental fractionation between the Sun and solar wind correlate with first ionization potential (FIP) with depletions of high FIP elements. Additional abundance data for NaKCrMnNi will permit a good test of the apparent lack of fractionation among low FIP elements which will be the basis for improving knowledge of solar nebula elemental composition.

- [1] McKeegan, K.D. et al., (2011) *Science*, 332, 1528, 2011. [2] Marty, B. et al. (2011) *Science*, 332, 1533. [3] Heber, V.S. et al., (2009) *Geochimica et Cosmochimica Acta* 73, 7414; A. Meshik et al., (2011). Abstract #2703. 42nd LPSC; Crowther S.A. and Gilmour J.D. (2011). Abstract #21969. 42nd LPSC. (4) Meshik A. et al., (2007) *Science* 318, 433; Heber V.S. et al., (2012) Submitted to *Ap J*; Vogel, N. et al., (2011) Abstract #1767 42<sup>nd</sup> LPSC. (5) Grimberg A. et al., (2006) *Science* 314, 1133. (6) Heber V.S. et al (2011). Abstract #2642. 42nd LPSC. (7) Jurewicz et al., (2011) Abstract #1917. 42nd LPSC.